THE CARPENTERS RVLE,

Or,

A BOOKE SHEWING MANY plaine rules, truly to measure ordinarie Timber, and other extraordinarie *solids, or Timber*:

WITH A DETECTION OF SVNDRIE great errors, generally committed by Carpenters and others in measuring of Timber; tending much to the buyers great losse.

PVBLISHED ESPECIALLY FOR THE GOOD of the Carpenters in London, and others also; and is also for Masons, Shipwrights, Ioyners, and all that have to measure Timber and Boards, and other superficies and solids.

By RICHARD MORR Carpenter.

AT LONDON
Imprinted by FELIX KYNGSTON. 1602.

BRITISH MUSEUM

AT LONDON
Imprinted by Felix Kyngston. 1601.

TO THE RIGHT WORSHIPFVLL SIR HENRY BILLINGSLEY,

Knight, Alderman of the Citie *of London.*

RIght worshipfull, when I had often considered the great errors, and by error the great losse comming to this Citie, in measuring of Timber after the common wayes; and had long expected some mans indeuour for redresse, but saw none: I was in a sort prouoked (though the vnfitteſt of a number) to attempt this thing. And becauſe it is not otherwiſe likely, but that I in this caſe, ſhall haue many oppoſers: I haue therefore emboldned my ſelfe, humbly to deſire your worſhips protection: crauing alſo your fauourable acceptance, of this my poore labour; that ſo it may be the better accepted for the common good.

Neither is my deſire, only to entreate your worſhips fauour and protection, but alſo to teſtifie my dutifull thankfulnes for your great paines and no ſmall coſt, in

publishing in our Englis[illegible] *Elements of Geometrie.* A booke, from wh[illegible] well may, so my selfe needes must confesse, [illegible] haue receiued all that little insight in Geometry, which I haue attained vnto. Yea such is that booke (as I may well say) that if mens tongues should be silent, yet their actions would not spare, plainly to declare the worthines thereof, to the praise of your labours. And thus in all duetie, craving your worships protection of [illegible] small fruite of your owne labours; craving also pardon for my boldnesse, I humbly take my leaue: desiring God to blesse and keepe you in all good estate, to the glorie of his name, the benefit of the Common-wealth, and the good of your selfe, in this life and the next.

Your VVorships in all dutie

RICHARD MORE.

TO THE WORSHIPFVL, THE MASTER, WARDENS, AND Assistants of the Companie of Carpenters of the Citie of London: And to all other the curteous Readers.

AFter I had long considered, and that not without some griefe, the great losse that commeth to those of my Companie and others, by errors ordinarily committed in measuring of timber; I did often thinke with my selfe what might be the readiest course to redresse them. One while I thought to have declared to you the Master and Wardens, what errors I had observed in our ordinarie measure, and so to have desired you in all dutie to have provided a remedie. But when I perceived, that custome had caused error to be received as a truth, and that therefore men would not forsake them, unlesse they were plainly convinced to have erred: And when I did also see, that most men are very ignorant in true measure, though they seeme and professe to know much therein; and did also remember that not only Carpenters in this Citie doe in this sort erre, but also Carpenters elsewhere, as also Shipwrights & others, and that throughout the whole land, for the most part: then this course seemed to me to be too private, and such as was like to doe but little good. The best course that I could thinke upon, was, to publish some booke, wherein not onely true measure should be set downe, but also the common errors plainly laid open to the capacitie of the simplest; that so all men might take knowledge thereof.

My selfe I knew to be very unfit for this worke, both because of mine inabilitie, as also by reason of some exceptions that diuers might

might take against me, to their [illegible] and my discouragement. But when I saw none addressed thereunto, then (remembring the saying of a Heathen, that men are not borne for themselues, but for their Countrey) I did set aside all feare, and both boldly and rudely haue put out this my simple booke, in manner as you see.

The booke I haue diuided into three parts. In the first part I declare the errors most commonly committed, and taken for truth, in measuring of timber. In the second part I shew how ordinarie timber may be measured, both by sundrie plaine waies, as also by waies more artificiall. And in the third part I shew how extraordinarie timber and sollid formes may be measured.

The errors ordinarily committed in measuring timber, are many. But of them all, especially two, bringeth losse to the buyer. The first is by buying of waynie timber and measuring it as square. The other is by taking halfe the breadth and thicknes of a peece being added together, for the square thereof.

These errors are such, as bring apparant dammage: and therefore they are not to be respected lightly. I would they might not bee said to be a great cause, if not of the ouerthrow, yet of the impairing of some mens estates.

For as for wainie timber, who knowes not, that as it is often measured and hewed, a loade and a halfe will not goe so farre in vse, as a loade of good timber being well hewed and iustly measured.

And as for haluing the summe of the two sides for the square, the dammage hereby is exceeding much; not onely to those that buy much Timber at the first hand, but also, and that especially (which is the more pitie) to the poorer sort that buy at the second hand. For my selfe haue abated of that which workmen themselues haue measured a peece vnto by the foresaid falseway, after 3, 4, 5, yea 6 foote of timber in 20: and yet I haue giuen them no more then their measure.

I cannot stand to amplifie these errors in this place: they are more fully set downe in the booke it selfe. By which (if they be well weighed and considered vpon) it will plainly appeare to be true as I haue said, namely, that there commeth great losse by the ordinarie measuring of timber.

Now seeing the case so stands, my desire and request is, euen to e-

very man, but especially to you the Master, Wardens, and Assistants of our Company; that you would put your helping hand to reforme these errors. Many reasons might be alleaged to induce you hereunto, but for some reasons best knowne to my selfe, I omit them all, not doubting of your care and regard hereunto.

I haue heard some men wish, that wee had an act of Parliament procured for redresse of false measure. But truly that seemeth to be the law of our land alreadie, though not the statute law: for the law intendeth that the buyer should haue that which he buyeth. And when we buy a loade of timber, doe we not intend that we haue bought 50. foote of sollid timber, euery foote being full 12 inches euery way, that is, in length, breadth & thickyes? Why then may we not require so much for a loade, and why is not the seller bound to deliuer it? And if a man that buyeth twentie bushels of wheate, will not take nineteene; or if he buy a yard of cleath, he will not take three quarters: Then why should we (buying a loade of timber) take 40. foote for it, yea and lesse too (as oft times it fals out) whereas wee should haue 50. foote.

I know that many men will obiect many things; and it is not for me at this time to refute them. Onely whereas some may say, that what is wanting in the measure, is allowed in the price. I answere: 1. That is not alwayes. 2. But where allowance is made, it is not according to the value of the losse cumming by the false measure. 3. Againe, it is a preposterous course, to raise or let fall a price by altering of a set measure to an vncertaintie, whereas we vse in all trades to raise or let fall the price according to the goodnes or badnes of the ware, keeping still the same measure for them both. And surely herein we are but deceiued: For oft times we haue twelue pence bated in the price of a loade, and lose foure or fiue shillings in the measure thereof.

Therefore let vs either haue iust measure, if we buy by measure; or els let vs buy it by gesse. For it is a shame to pretend to measure truly, and yet doe nothing lesse.

As touching my selfe, I desire that my endeuour may be fauourably accepted: for I write with no other mind then as tendring my Companies good. If any thing that I haue said, be impugned as false, I will be readie whensoeuer you will call me, to proue my affirmations.

If

If any man of knowledge shall except against me, for my rude writing and grosse demonstrations: I pray them to understand, that I write not for them, but for the simple; and therefore demonstrate grossely, not being well able to doe better: Also, that I am not a scholler but a Carpenter, and therefore could not but write rudely. Vnto such also I doe further say, that my desire is, that they would take knowledge, that this hath been one cause of my writing, even to provoke them (seeing our present error and losse, with which peradventure they were not so well acquainted as my selfe) to take some paines to reforme the same, in better sort then either I have or can doe.

While this booke was in printing I came to the sight of a Ruler, sometimes invented by one Master Bedwel; which as it is easie, so it is most speedie, and not lesse certaine (being truly made) for the measuring of timber and board; which I expect and hope will be shortly published for the common good. But I will not trouble you with more words. Onely let me put you in minde of this one thing: That in as much as nothing is more fit for Carpenters to make them readie, not only in measure but also in other things, then Geometrie: that therefore such as are of reasonable capacitie, would spend some part of their spare times to studie the same, in some measure at the least. For your furtherance herein, there are especiall good helps, both by the Lecture at Gresham Colledge every Thursday in the Terme times (if you were but a little entered) as also by Euclides Elements of Geometrie, which the right worshipfull Sir Henry Billingsley Knight, to the great good of the Common-wealth, though to his own great travell and charge, hath translated and published in our English tongue. But I am over tedious: I pray you accept of this my poore endeavour, as a fruit of my hearty good will to my Company, and others whom it may concerne. If it take some effect, I shall be sorrie: but if it doe any good, I have enough for my labour.

Richard More.

THE FIRST PART OF THE CARPENTERS RVLE,

shewing diuers grosse errors, generallie committed by Carpenters and others in measuring of Timber, arising from the Rule, and the vse thereof.

CHAPTER. I.

The error in the Rules, and the reason thereof.

THose that indeuour to amend things amisse, must first of all labour to proue the faults, especially when the parties deceiued, are not yet perswaded, that they are out of the way. And because men little regarde to returne vnto the right, when they doe not perceiue that they are far in the wrong: I haue therefore thought good to spend this first part of my booke, in shewing and declaring, that great error is to be ordinarily committed (by the most part of Carpenters and others in and about London, and elsewhere) in measuring of timber.

These errors doe arise, either by meanes of the Rule or Ruler, with which they measure Timber; or else by the misapplying or vsing thereof. I meane, the ordinarie way of measuring Timber is very erroneous. But first of the faults to be obserued in the Ruler it selfe.

The ordinarie Rule which Carpenters, Shipwrights, and others doe vse to measure Timber withall, was inuented and published by Master Leonard Digges. Now those Rules that agrée with that booke are so true, as that I déeme them ouercurious that except against them; and they will serue truly to measure Timber withall. But the most which haue that kinde of measure on them which Master Digges describeth, are very false. I meane, those diuisions or strikes which are set on them for measuring of Bord and Timber, are not in their right places.

Digges Tectonicon.

And as those strikes and diuisions agrée not with the truth, so vpon diuers Rules you shall finde them to disagrée one from another: Yea hardly shall you sée two Rules that do euery where agrée. Neither is this error insensible, and so not to be respected; but apparantly grosse, and therefore not to be tollerated. For my selfe haue séene some Rules that in some of their diuisions haue erred from the truth and from one another, after the rate of sixe foote in an hundreth of Bord, and after foure foote in a lode of Timber. Neither is this error rare and in some alone, but so generall, as that if a man would examine them, he should be forced to say, that true Rules are very scant.

If I were demaunded the cause of this fault or error in the Rule, I should answer, that in mine opinion it ariseth hence. Many will take vpon them to make Rules, who haue not Master Digges his booke to make them by; or if they haue it, vnderstand it not, neither the ground from whence the Rule is made, by which they might examine the Rules which they make: which ground is set downe in the eleuenth and twelfth chapters of the second part of this booke. But ordinarily men make them one by another, whereof hath growne the former error.

Thus much for the Rule. Now should follow to shew the errors in measuring Bord and Planke: But because I haue obserued no maine error in measuring of ordinarie planke or Bord (though great fault in buying of waynie

Bord, and measuring it as square) which I speake of in the next chapter following. I will therefore say nothing thereof now, but passe to errors in measuring of Timber.

Chap. 2.

The great losse that commeth in buying of timber and Boord that is wainie, and measuring it as square.

Every man that buyeth Bord or Timber, intendeth to haue for a foote as followeth, that is to say, in Bord twelue ynches in length; and twelue in breadth; and in timber, twelue ynches in length, twelue in bredth and twelue in thicknes. But who so buyeth Timber or Bord that is waynie, and taketh it as if it were not waynie, hath not his measure for his monie, but farre lesse. This is a great fault, and generall throughout the whole companie, and amongst others also; yea and apparantly knowne and noted by euery man, and yet not amended nor indeuoured to be amended by any.

This fault in Bord seemeth to come from carelesnesse, and in Timber (as I take it) it did first grow from ignorance. For when men knew not how to measure a waynie peece of Timber, nor how to deduct the waynes, hauing measured it as not waynie; then they did carelesly ouerpasse this thing as a necessarie euill, or as an inconuenience that could not be auoyded.

But it may be said, that there is allowance in the price. I answere, what is it in a loade of Timber or in a perfell of Bord to haue twelue pence abated in the price, and to lose foure or fiue shillings in the measure. This is to get in the hundreth and lose in the shire.

And besides this losse that commeth by waynie Timber, there is also another great losse thereby not to be forgotten. You know that when the Timber is very waynie, we are compelled to hew away a great part of it, after it is sawed

to bring it to some reasonable squarenes fit for vse. If then you shall put this losse to the other, you shall finde, that it is no small damage that commeth by buying of waynie timber. And therefore there should be an extraordinarie care and respect had to the measure, that we lose not by it, seeing so great losse commeth by the stuffe it selfe.

My desire therefore is, that as other faults; so this may be amended. Not that I would haue Timber hewed dye square, for that were a spoyle of much good Timber: nor that I would haue girt measure vsed, for that (in this kinde) is very false, as appeareth afterwards: But I would haue the want or waynynesse deducted or taken out of the whole peece; which how it may be don, is shewed in the second part of this booke, Chapter 5.

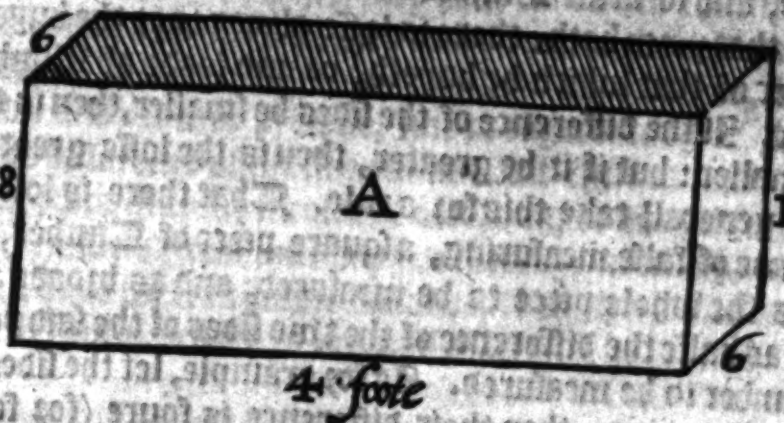
Chap. 3.

That it is very false, to take for the square of a peece of Timber, the halfe of the breadth and thicknes, added together: by which square, should be found the length of a foote in that peece.

IT is a common practise, and that of ould, that who so of the ordinarie and common sort of men, doe measure Timber, they take this course. First they ad or put together the breadth and thicknesse of the peece of Timber to be measured; then they take the halfe thereof for the square of the same peece; and then according to that square, they giue the length of a foote by the Rule. As for example, if the peece be ten ynches one way, and fourteene ynches the other way, they ad together ten and fourteene, which make twentie foure; the halfe of twentie foure is twelue, which (say they) is the square of this peece of Timber; which is very false. And yet this course is so generally receiued, and so commonly reputed and taken for good, as that he shall be thought ouercurious of some, that shall but except

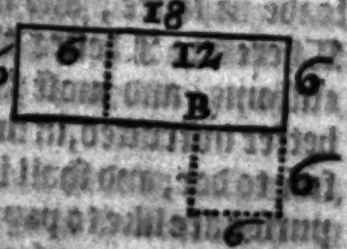
except against it. Howbeit if you will but marke that which followeth, you shall plainely see that it is an error, and that a great one.

Suppose therefore that this figure or picture marked with the letter A. were a peece of Timber, having for his length



foure foote: for his thicknes fiue inches: and for the breadth eighteene inches. Now this peece of Timber is indeede but three foote of Timber, where as by the former way it is foure foote: For eighteene inches and fiue make twentie foure, the halfe whereof is twelue.

Now to proue and demonstrate the error, behould the figure marked with the letter B. which suppose to be the end of that peece of Timber onely, having (as you may see) for the breadth eighteene inches; and for the thicknes fiue inches. Then cut off by the prickt line; twelue inches from the breadth, being eighteene inches; which twelue inches, is supposed to be the side of the square of the said peece. This done, there remayneth fiue inches, which remaynder, suppose to be layd vnto the lower side of the figure B. and then there doth appeare a defect, or want of a peece, of fiue inches square. For howsoeuer the remainder hath fiue inches breadth, which being laid to fiue, the breadth of the whole



figure, it makes twelue; yet hauing but fiue ynches for the length also, it wants fiue of twelue to which it is applyed. As by the beholding of the figure it doth plainly appeare.

Thus then appeareth the error. If you will know the greatnes thereof, you shall vnderstand, that in the former example, and so in all Timber that haue like differences of sides as that péece hath, there is losse alwayes to the buyer, a quarter of that which he buyeth, or one loade of Timber in foure. If the difference of the sides be smaller, then is the losse smaller: but if it be greater, then is the losse greater. And in generall take this for a rule. That there is lost by this kinde of false measuring, a square péece of Timber, as long as the whole péece to be measured, and as broade and thicke as halfe the difference of the two sides of the said péece of Timber to be measured. As for example, let the sides be ten and fourtéene, then their difference is foure (for fourtéene is more then ten, by foure) now the halfe of foure is two, which two is the side of the said lost square péece of Timber throughout the péece.

Now séeing this error of taking halfe the sum of the sides for the square, is very manifest; and seeing also it is an error tending to the great losse of the buyer, yea to the losse of three loade in foure, and more also as the differences may be: Therefore I desire that none would follow that corrupt custome, and most false way; but suffer themselues to be better instructed, in more rightter wayes. Which if they refuse to doe, and shall buy much Timber after that rate, their purses are like to pay for it.

But some may say vnto me, this fault is by diuers discerned, and a redresse not altogether vnthought of. I graunt, many doe sée it, and doe indeuour to reforme it thus. If a péece of Timber bee eightéene ynches one way, and fiue ynches the other way, they imagine it to consist of three squares of fiue ynches a péece (as indéede it doth) the which they measure seuerally, and then adde al their contents together, which they take for the measure of the whole péece.

This

This is true both in this example, and in all others that will fall out in any number of iuſt squares. But when the ſides of the Timber to be meaſured, haue not this anſwereablenes in them, as nine ynches one way and fourtéene the other way; or ſeauen and nintéene, or ſuch like; then they are to ſeeke. For when they haue taken the thicknes out of the breadth as often as they may, then is the remainder vnſquare: In meaſuring whereof, they faile and erre, as afore-ſaid; and yet they profeſſe, not to regard it. For (ſay they) if the difference of the ſides be not paſt three or foure ynches, that péece may be meaſured according to the ſaid erroneous way, and no great loſſe happen thereby. But what the loſſe is, I haue ſhewed before, which although it ſéeme but ſmall, yet in time it ariſeth to no ſmall matter.

CHAP. 4.

The error in meaſuring of timber not hewed ſquare but beuell.

ALthough this error be not of any great moment, becauſe Timber hewed beuell or ſkew, commeth not often to be meaſured: yet becauſe ſometimes there is ſuch Timber to be ſould, I would not haue workemen to be ignorant, that it is an apparant error to meaſure it, as if it were hewed ſquare.

When the corners of the Timber are hewed vnſquare; I doe not meane waynie; for of that I haue ſpoken before in the ſecond chapter: but when it is hewed beuell or diamond wiſe (as ſometimes it is by the careleſneſſe or vnſkilfulnes of the hewer) then to take the ſquare of ſuch Timber, according to the breadth of the ſides thereof, is vntrue; for the ſides are longer then if it were ſquare, and ſo giues the péere to be bigger then it is.

How great this error is, I ſtand not to ſhew at this time: Only note that it doth increaſe and decreaſe according as the

corners

corners of the Timber doe swarue from square. But how such Timber is to be measured, see in the third part, Chapter the first.

Chap. 5.

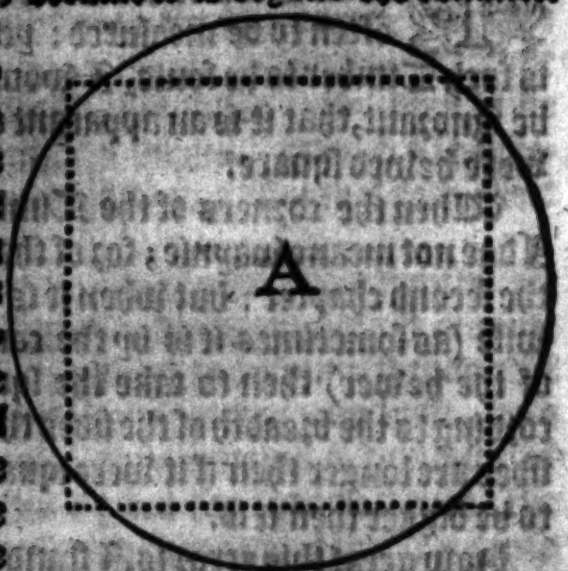
The error in the ordinarie measuring of round Timber.

The former errors doe alwayes bring losse to the buyer, but these that follow doe alwayes bring losse to the seller. And though such round Timber commeth not often to be measured here in London (the worse for the buyer) yet would I haue Carpenters know the error which is vsed in measuring the same; which is this.

They girt the Timber rounde about with a line or thread, and then take one quarter thereof for the square (as we call it) of the peece to be measured, and so finde out (as they thinke) the length of a foote in that peece of Timber or tree.

This is a grosse error, and yeeldeth not the content of the peece or tree, by one fift part of it and more.

I will not stand to demonstrate this or any thing else in this booke geometrically, because it is beyond the common capacitie. But yet you may perceiue the greatnes of this error, onely by beholding this figure A. where I haue made a square with prickes, in the circle: the foure sides of which square are equall to the length of the circumference or ring of the circle, which circle you must imagine to be the end of a round peece of Timber to be measured. Now this square, euery man can



perceiue

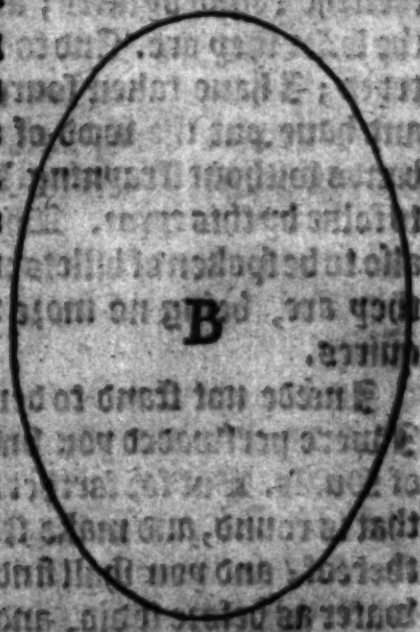
perceiue to be lesse then the circle, though he cannot tell how much.

But how round Timber is to be measured is taught in the first chapter of the second part, and in the ninth chapter of the third part of this booke: which when you haue learned and tryed, then you will tell your selfe, that in measuring round Timber after the former way, is very erroneous and intolerable.

Chap. 5.

Error in measuring of Timber not fully round, but somewhat flat called Quall fashion.

Those that doe their worke but by guesse, doe not sticke at small differences; and therefore they measure by one and the same way, both that Timber that is perfectly round, and that also which is somwhat flat, called Quall fashion, as is the figure marked with the letter B. I shewed in the last chapter, that it was false to measure a circle by taking it to be equall to a square, whose foure sides are equall to the circumference or ring of the circle. And to measure Quall fashion, or that which is not perfectly round but somwhat flat, by the same way, is also false. Onely herein is the difference, that in measuring a circle by the said false way, the error in all circles is alwayes alike; but in Quals the error varies. For the flatter they be the lesse is the error, vntill it be so flat, that it be equall to the square, whose foure sides are equall to the ring or circumference: and after



that, the flatter they be, they are still the lesser, and alwayes lesser then the said square.

So that to measure Duals by the former way, is so vncertaine, that you may haue peraduenture more then you should, and peraduenture lesse then you should by a fift part, a fourth part, a third part, and so forth. But because (ordinarily) trées or Timber that are Duall fashion, doe not much vary from a round: Therefore the losse is alwayes to the seller, being measured as aforesaid.

Here I had purposed to haue somewhat digressed from my generall purpose, and to haue shewed the great losse that commeth by buying of fagots that are bound flat: But the Statute for fewell in the last Parliament hath preuented me: Where it is enacted, that bands of fagots shall be Round. But yet because I feare al men vnderstand not what is ment by the word Round, or if they doe, yet they will not regarde to redresse it: I pray you therefore take knowledge, that where as men doe commonly buy the flattest fagots for the greatest, they are deceiued; for indéede they are lesse then the round by farre; and euermore the flatter they are, the lesser they are. And to speake no more then my selfe haue tryed; I haue taken foure fagots (indéede of the flattest) and haue put the wood of them all into three of their owne bands without straining. Lo then the great losse that comes to folke by this error. That which I say of fagots I intend also to be spoken of billets: For the flatter they are, the lesser they are, being no more in compasse then the statute requires.

I néede not stand to demonstrate that this is an error, if I were perswaded you vnderstood that which is said before of Duals. But for farther proofe, take a quarte pot of penter that is round, and make it more flat by crushing in the sides thereof; and you shall finde that it will not hold a quart of water as before it did, and yet the compasse of the pot is as much as it was before. You may also proue the same by a Word thus. The fagot band ought to be by the Statute

twentie

twentie foure ynches about: So then a Wordes end of a foote broad will hardly goe into one of those bands; but if you cleane that Wordes end into a dosen or more péeces; you shall well perceiue that you may put foure and more of such Wordes being so cleft, into that band being round. This haue I written, not carpingly, but as desirous that the buyers would not deceiue themselues by their eye, neither that they should be deceiued by others.

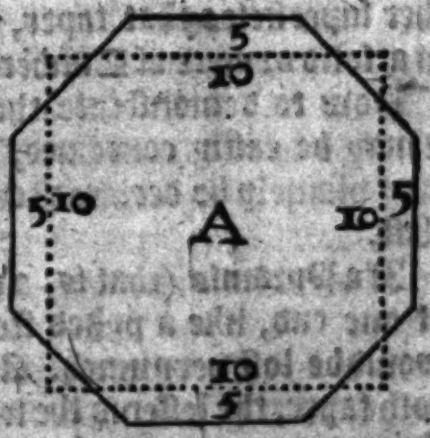
Chap. 7.

The error in measuring timber that is waynie.

I Told you before in the second chapter, that there comes great losse to Carpenters in buying of waynie Timber after the ordinarie way: But here I shew the losse that comes (indéede not to the buyer but the seller) in measuring of waynie Timber.

It hath béen vsed (as I am informed) that if Timber were waynie, the buyer would measure it as by girting it about, and taking one quarter of the compasse for the square, as in the case of round Timber before shewed, chapter the sixth. But it séemeth to me, that the seller grew wearie of this way, so that in my time to my knowledge, it hath not been vsed in or about this Citie.

To proue this course to be erronious, behold the figure A. the which suppose to be the end of a péece of Timber that is waynie or canted into eight equall cants of fiue ynches a péece: Or, the figure is a figure of eight equall sides, whereof euery one is fiue inches. Now girt this péece about, and it will



come to foztie inches, the quarter whereof is ten inches,

for the square of that canted péece. According to these ten inches, I haue made a square within the canted péece by certaine prickt lines: By the very beholding whereof you may sée that the canted péece is bigger then the said square of prickt lines is, and so that losse commeth to the seller.

How much this losse is, doth not appeare by this demonstration. But in this figure (if you will take my word) there is lost a first part full. But I had rather you would trie the losse your selues, by the rule taught in the fift chapter of the second part of this booke, then to beléeue me in this case.

Chap. 8.

That in measuring of Timber that is taper growne, it is false to take the square of the middle thereof, and so to giue vp the content by the common Rule.

IT is so vsuall a thing in measuring of Timber that is taper growne, or narrower at one end then at another, to take the square of the middle of the péece, and so to measure it by the common Rule; as that it shall be not onely not beléeued, but also reputed to haue apparantly erred in affirming the contrary: for it will be said, that that which it hath too much in the greater halfe, it wanteth in the lesser halfe. Indéede this is true in Woods or other superficies that taper, whose sides are straight: but in a solid or péece of Timber it is simply false.

How to demonstrate the error on a paper, so as that it may be easily conceiued, is very hard: but in a solid it may plainely be declared to the vnderstanding of the simplest.

If a Pyramis (that is, a pyked péece of Timber, sharpe at one end, like a pyked steeple) were so measured, there would be lost very much. And alwayes the lesser the péece doth taper, the lesser is the losse. In generall, there is lost, (by certaine pyramides) a péece of Timber whose length is

the first part of the length of the whole peece, and whose end or base is contained under halfe the difference of the sides of both the ends of such a tapered peece: that is, take for the breadth of the last peece, halfe the difference of the breadth of both ends; and for the thicknes of the last peece, halfe the difference of the thicknes of both ends. As for example, if the peete be twentie inches broad and fiftéene inches thicke at one end, and fiftéene inches broade, and twelue inches thicke at the other end, and twentie foure foot long: then the last peece is foure foote long, two inches and a halfe broade, and two inches thick: for two and a halfe is the halfe of fiue, which is the difference of the breadth of both ends; and two is the halfe of foure, which is the difference of the thicknes of both ends.

The losse that commeth by this error is to the seller: and yet in truth it is such as yéeldeth no profit to the buyer. For we lose more by such Timber, being imployed to any ordinarie vse, then that aduantage by the measure doth come vnto. But yet I would not haue workemen to take that way for a true measure which is false; neither to be ignorant how such Timber is to be measured, if occasion doe offer, or if men shall require it.

In the second and third part of this booke, where I shew how to measure Timber, I will shew how tapered Timber may be measured: from which I will no longer detaine you, taking that to be sufficient which I haue written alreadie, to shew the grossest of the errors, generally committed by Carpenters and others, in measuring of Timber.

The end of the first part.

THE SECOND PART OF THE CARPENTERS RVLE,

Wherein is set downe sundrie plaine wayes, truly to measure ordinarie Timber, And Boord.

CHAPTER. I.

How Boords and planks are ordinarily measured.

IN the former part of this booke, I told you that I had not obserued any maine errors in measuring of ordinarie Boord and planke, though great fault in buying of waine boord and planke, and measuring it as square: And therefore it shall not be needefull to inuent or set downe any new wayes of measuring of them: onely it shall suffice to repeate the wayes alreadie in vse ordinarily, which are three. Of which, the first is troublesome, and therefore rather to be knowne for varietie, then vsed in measuring. The second is true, but longer in doing then the third; and therefore I would aduise the third to be followed and vsed. Only looke that your Rule be truely made, and that diligence be vsed in measuring therewith: else there will follow error of necessitie, bee the wayes to measure by, neuer so exact.

The first way to measure boord.

The first way let be this. And first note that for this purpose, I call an ynch that which is an inch broad and twelue ynches

ynches long, of which ynches, twelue doe make a foote. Now if the Bord to be measured be vnder a foote in breadth, then reckon how many times twelue of the said ynches you can haue in the whole Bord, and so many foote is there in it. If the Bord be iust a foote broade, then it containes so many foote as it is féete in length. But if it be more then a foote broad, then measure it as aforesaid as if it were two Bords, the one of a foote broade, the other so broad as the odde inches remaining: then adde their contents together for the content of the whole bord.

This rule, to them that vnderstand it, may be further set downe in other words thus. Multiplie the number of inches in the breadth, by the number of foete in the length: then diuide the product by twelue, and the quotient shewes the number of féete in the bord.

The second way is thus. Measure the length of the bord: Then (if the same bord be vnder a foote brode) draw or set the breadth thereof so many times on the bord, as it contayneth féete in length, and there make a pricke: And then so many foote as there are from the beginning to that pricke, so many foote doth the bord contayne. The second way to measure boord.

And if the bord be aboue a foote broade, then you may take out the euen féete, and measure the remainder as aforesaid; and then adde both those together for the content of the whole.

The third way, is this. Take the breadth of the bord; then finde by the Rule what length, maketh a foote, at that breadth; and then sée how many times that length is in the bord, and so many foote are in it. These I stand not vpon, because they are well enough knowne to all men. The third way to measure boord.

CHAP.

Chap. 2.

How to measure Timber by a certaine way called Drawght-measure.

This way may fall out so tedious, as that I would not haue troubled either my selfe to write it, or you to reade it, had it not been that I would not haue you ignorant of that way which some doe vse in some places of this Land. The way is thus.

Suppose this figure A B to be a peece of Timber being in length foure foote, in breadth nine ynches, and in thicknes foure ynches. Nowtake the breadth or thicknes, which you will (but here let it be the breadth nine ynches) and note what that wanteth of a foote, which is three ynches. These three ynches set on, or draw alongst the figure or peece of Timber foure times, that is, so many times are there is feete in the length of the peece, beginning at one end, which let be heere the end A; and where that endeth make a pricke, which let be the pricked line next vnto the end A: And this is the

first worke. The second followes. Then must you measure how many foote it is from that pricke vnto the end B, which in this example is three foote. Then note what the other side of the peece, which was foure ynches, doth want of a foote, which is eight ynches. These eight ynches draw alongst the peece three times beginning at the end B, that is, so many times as there is feete from the said first pricke to the end B; and where that endeth make the second pricke, which let be

the

the prickt line next to the end B. Then the space betweene these two prickt lines shewes the content of the peece of Timber; (which space in this example is twelue ynches: So that this peece is one foote of Timber.) My meaning is, the peece of Timber to be measured, is so many foote as the space betweene those two prickes is feete in length. And if there fall out any odde ynches in that space, they are so many twelfth parts of a foote, as there be ynches; so that sixe ynches is halfe a foote, and three ynches a quarter of a foote, and nine ynches three quarters of a foote, and so forth.

This rule aforesaid will hold true for any Timber that is vnder a foote square. But if it be aboue a foote square, and not aboue two foote square; then must you imagine that one quarter thereof is to be measured (and therefore take but halfe of each of the two sides) and when you haue so cast it vp as if it were but a quarter, accompt foure times so much for the content of the whole peece.

But if the peece of Timber be aboue two foote square, and not aboue foure foote square; then may you imagine that a sirteenth part thereof is to be measured. Which done, accompt sirteene times so much for the content of the whole peece: now to take the sirteenth part, you may take a quarter of the breadth, and a quarter of the thicknes.

But this kinde of measure if it fall out in a peece of Timber aboue a foote square is so tedious, as that I doe wonder any man would content himselfe with it. And yet because I haue set it downe, take one note more, which is this. If the peece to be measured haue any od ynches in the length, either at the first or second working: then must you, hauing drawne the want so many times as there is feete in length, adde thereunto such part of the want, as the od measure of the length is part of a foote. And thus much of Drawght measure.

Dno. CHAP.

Chap. 3.

How Timber may be meaſured by Boord meaſure onely.

When I conſidered the readines of many men in meaſuring of bord by one of the three former wayes, and how ſpeedily they will caſt vp the whole ſtocke hauing meaſured one bord, by the obſerning of ſkores, tens, and fiues therein; and withall conſidering the great error that thoſe men run into in meaſuring of Timber: This moued me to thinke of ſome courſe, how theſe men that are ſo expert in meaſuring of bord, might by the ſame way meaſure any ſquare peece of Timber.

This way, though it be true, yet it is troubleſome; and therefore I would wiſh them rather to vſe ſome of the wayes following: But if their readines in caſting vp a ſtocke of bords ſhall cauſe them to accept of this way, I will not be their let. Now the way is this.

Suppoſe the peece of Timber (to be meaſured) to be a ſtocke of bordes, conſiſting of ſo many bordes as there be inches in the thicknes of the peece. Then meaſure one of thoſe ſuppoſed bordes: that done, caſt vp the whole ſtocke. Now this being performed, you are to know that euery twelue foote of bord is a foote of Timber, as euery man may perceiue; and fiue foote of bord is halfe a foote of Timber; and three foote, is a quarter of a foote of timber. Alſo, euery three ſkore foote of bord is fiue foote of Timber, and ſo, fiue ſkore foote of bord is ten foote of Timber, nine ſkore foote of bord is fiftéene foote of Timber, twelue ſkore is twentie foote, fiftéen ſkore or three hundreth, is twentie and fiue foote, fiue hundreth foote of bord is fiftie foote of Timber, and ſo forth. Now if this be obſerued, it is eaſie for any man to caſt vp the content of any ordinarie peece of Timber truly.

There

There is farther to be noted, that if there be any od halfe ynches in the thicknes of the péece to be measured, that then it be accoumpted as halfe of one of the supposed bordes of the stocke: And if there be a quarter of one inch, then it is a quarter of a bord: And if there be an od thrée quarters of an inch, it is thrée quarters of a bord; and if there be any other od part of an inch, it is the same part of a bord, and must be counted with the whole stocke.

This way is so plaine that it néedeth no example. I suppose the simplest may vnderstand it, and therefore I will say no more of it: Onely this you may obserue, that you may measure the péece, by imagining it to be diuided into two inch, thrée inch, or foure inch planke; so that you search out how many foote of such planke is contayned in a foote of Timber.

Chap. 4.

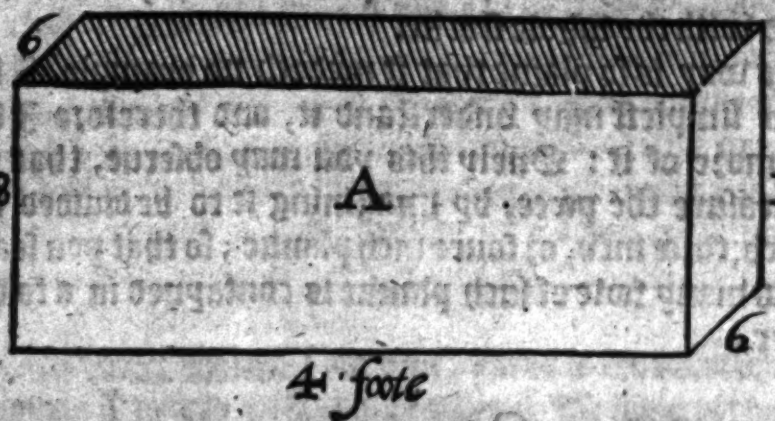
How Timber may be measured after the ordinarie way, by deducting the lost square.

IT was obserued in the third chapter of the first part of this booke, that when any péece of Timber is measured after the most common way, which is by adding the breadth and thicknes together, and taking the halfe thereof for the square of the péece, &c. that then there is alwayes lost a square péece of Timber of the whole length of the péece to be measured, whose square is halfe the difference of the two sides of the péce. Now by obseruing of this lost square, any ordinarie péece of Timber may be truly measured as followeth.

Measure the péece, by taking for the square thereof, the halfe of the summe or totall of the two sides, as is aforesaid, and as is vsually accustomed. This done, note the difference of the two sides: then take the halfe of that difference for the side of the lost square, which is all the length of the péece.

Then meaſure that ſuppoſed or loſt ſquare, and what it amounteth vnto, deduct out of the meaſure of the whole péece being meaſured after the ſaid common way, and the remainder is the true content of the péece.

As for example, ſuppoſe the figure A to be a péece of Timber, hauing for the length foure foote, for the breadth eighteene inches, and for the thicknes fiue inches. This being meaſured after the moſt common way is foure foote of Timber, and ſo let it be meaſured. Then note the difference of the two ſides, which is twelue inches (for eighteene is more then fiue by twelue.) Then take the halfe of twelue, which is fiue; this fiue is the ſide of the loſt ſquare. Now meaſure that ſquare of fiue inches being as long as the péece to be meaſured (which is foure foote) and you ſhall finde it to be a foote of Timber. This foote deduct out of the content of the péece as it was before meaſured after the common way, and there will remaine three foote, which three foote is the true content of that péece marked with the letter A.



And becauſe the loſt ſquare may haue in it an odde halfe inch, as ſome times it hath, as three inches and ahalfe or ſuch like: I haue therefore added vnto the common rule, what length maketh a foote of Timber from an inch to ten inches, noting ſtill euery halfe inch: As you may behold in the table of Timber meaſure hereafter following in the latter ende of this ſecond part. For to take halfe the

difference betwixt the two next adioyning numbers of inches added to the lesser of them (as commonly men doe) is not true: As for example; at an inch square one hundred forty foure foote in length maketh a foote of timber: at two inches, thirtie six foote doth it: so that if the halfe betwixt thirtie sixe and one hundred and forty foure were taken and added to thirtie sixe for the length of a foote at an inch and a halfe square, it would be nintie foote, whereas in truth it is but sixtie foure foote: so in this example it erreth twentie sixe foote in length of a peece of Timber of an inch and a halfe square. And how so euer it be not so much in other numbers aboue two inches square, yet it alwayes erreth more or lesse.

Chap. 5.

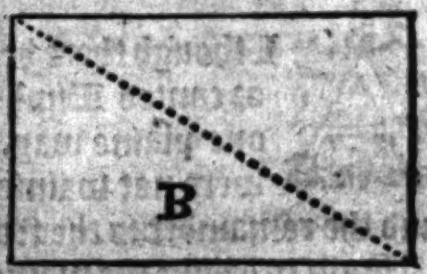
How wainie or canted Timber may be measured.

Although there be diuers wayes to measure wainie or canted Timber, yet I will obserue onely this one plaine way. Measure then the peece as if it were not wainie, out of which deduct the waines, and the remainder is the true content of the peece.

How to deduct the waines is better taught by an example then by a precept: and therefore suppose the figure A were the ende of a peece of Timber of ten inches square, hauing one corner thereof wainie: this peece measure as if it were not wainie. That done, measure what the waine is either way from the corners, which I call the wants, because the peece wanteth so much of square; which want in this example is

foure inches either way, as you may ſée by the two pricke lines with the figure of foure ſtanding by either of them. This meaſure as if it were a péece of Timber of foure inches either way, and as long as the whole péece. That done take halfe the content thereof; the which halfe deduct out of the meaſure of the whole péece as it was before meaſured; and the remainder will be the true content thereof. And as you doe with this corner, ſo muſt you doe with the reſt, if they be waine alſo.

And here I would haue you note, that where I bid the halfe of the content of the ſaid ſquare to be deducted, that the reaſon hereof is, for that in Geometry, all parallelograms and parallelipipidons, are deuided into two equall partes by their diameters, as it is demonſtrated in Euclide, booke, 1. propoſition 34. and booke 11. propoſition 18. That is to ſay in playner termes for our purpoſe, a bord or a péece of Timber which haue their oppoſite or contrarie ſides equally diſtant, being cut into two péeces by a ſtraight line paſſing by the oppoſite corners, as you may ſée in the figure B, I ſay, that bord or péece of Timber, is cut into two equall parts. So that it is manifeſt by this, that the ſaid waine is halfe ſo much as the péece whoſe ſides are equall to the ſaid wants.



Chap. 6.

How round Timber may be meaſured.

I Told you before, that I would not trouble you with Geometricall workes. And howſoeuer I doe hereafter ſet downe ſome more artificiall wayes to meaſure by, yet my indeauor eſpecially is to correct the common errors by that knowledge which moſt men haue

aſſeadie: and therefore you may meaſure round Timber plainly in this ſort. Girt the piece about with a line or threed: then take a quarter thereof for the ſquare of that piece, (though indeede it be not the ſquare) and ſo meaſure it after the common way. But now, note that which I told you in the firſt part of this booke, namely that this piece is more then it is thus meaſured to be. And therefore to finde the true content, adde to that which you haue meaſured the piece to be, a quarter thereof, and alſo after the rate of a foote in a loade, and then the totall will ſhew the content of the piece, though not exactly, yet ſo neere, as that the loſſe will not bring any dammage to any man, that is worth looking after.

See a more exact way in the third part of this book, chap. the 10.

Take an example for more plainnes. Suppoſe the tree being meaſured after the former way to containe twentie foot: then muſt you adde thereto a quarter thereof which is 5, and that makes 25 foote. Then adde to that, halfe a foote, which is after a foote in a loade, and the content of the piece will amount to 25 foote and a halfe.

And here is to be noted, that if the piece bee not exactly round, that then this meaſure will not hold, as was ſhewed in the ſeuenth Chapter of the former part of this booke. But how ſuch Timber is to be meaſured, ſee in the latter end of the eleuenth Chapter of the third part.

Chap. 7.

How Timber may be meaſured by Arithmeticke.

Though the former waies for meaſuring of Timber be ſufficient, yet becauſe varietie giueth pleaſure, and theſe that follow admit of leſſe error in the working then ſome of the former, I haue therefore thought good to ſet them downe as followeth. And if any man ſhall obiect that I ſpend this labour in vaine, becauſe Carpenters commonly haue not Arithmetick. I anſwere, that ſome haue

more

more knowledge therin, then they know how to applie to the preſent purpoſe; for whom chiefly I haue writtē this chapter and ſome others following: as alſo I could wiſh that others which haue not, would learne; which they may do by bookes which are extant: or at leaſt forbeare to be common Rule-makers, vntill they haue knowledge therein, or well vnderſtand the tables which are for that purpoſe.

Here firſt I ſhould haue ſhewed how to meaſure boords by Arithmeticke: but becauſe it little differeth from meaſuring of paralellograms, I will therfore referre it to the third part of this booke, where it is taught how to meaſure them.

Now to meaſure Timber by Arithmeticke, doe thus. Reduce the length of the piece to be meaſured into inches, by multiplying the number of fēet therein contained by twelue. Then multiplie the breadth by the thicknes, and the product or ſumme therof multiplie by the length, being alſo reduced into inches, as afore ſaid. Then diuide that product or ſumme by 1728 (which is the number of inches in a foote of timber) and the quotient will giue you the number of feete contained in that piece of timber.

Here it ſhall not be vnneceſſarie to giue two examples; the one where the lengeth, breadth and thicknes are euen inches; and the other, where they haue odde parts of an inch.

Suppoſe the piece of timber to be meaſured to be nine foote in length, eightēne inches in breadth, and fiue inches in thicknes. Now multiplie nine foote the length by twelue, and that yēelds 108. inches, which being multiplied by 18. the breadth, makes 1944. and that being multiplied by fiue the thicknes, yēeldeth 11664. which is the content of the whole piece in inches. Then diuide this 11664. by 1728. and the quotient will be fiue foote and $\frac{1}{1}\frac{2}{7}\frac{9}{2}\frac{6}{8}$ parts of a foote, which being reduced to his lowest denomination, is $\frac{3}{4}$ of a foot. So that the whole piece is fiue foote and three quarters. And if you would know how many quarters of a foote is in any ſuch fraction, you may diuide it by 432 the number of inches in a quarter of a foote of timber, & the quotient will tell

you.

you. But suppose the piece haue in the breadth or thicknes, an od quarter, or halfe, or three quarters of an inch: then reduce the length, breadth and thicknes into quarters of inches: after that, multiplie them being so reduced one into another, that is, the length by the breadth, and that ofcome or product by the thicknes. Then diuide that totall by 110592 (which is the number of quarters of inches contained in a foote of timber) and the quotient will shew you how many foote is contained in the piece. As for example, let the piece be 20 foote long, 8 inches and a halfe broad, and 11 inches and three quarters thicke: First I reduce 20 foote the length into quarters of inches by multiplying 20 by 12, which is 240, which brings 20 foote into inches: then I multiplie that 240 by 4, to bring them into quarters of inches, which is 960. Secondly, reduce 8 inches and a halfe the breadth, into quarters of inches, which is 34. Thirdly, reduce 11. inches and three quarters the thicknes into quarters of inches, which is 47. Then multiplie 960, and 34, and 47, together, and they make 1534080. Lastly, diuide these by 110592, and the quotient will be 13, and 96384 odde quarters of inches: which being diuided by 27648, the number of quarters of an inch in a quarter * of a foot of timber, the quotient will be three quarters of a foote, and somewhat more, but it is not to be regarded in a whole piece of timber: so that the content of the piece is 13 foote, three quarters of a foote and somewhat more. This is more tedious to teach then to practise. Behold the worke on the other side of the leafe.

*Note here that I mean not by a quarter of a foote, a square of 3. inches, which is a quarter of a foote one way: but the fourth part of a square foot of timber.

20 foote long. $8\frac{1}{2}$ inches broad. $11\frac{1}{4}$ inches thicke.

12	4	4
40	34	47
20		
240		
4		
960		
34	638	
3840	38298	1344
2880	42984 foote.	35560 quarters.
32640	1534080(13	96384(3$\frac{11}{12}$
47	1428	27648
228480	1428	
130560		
1534080		

Note, that where there is no odde parts of an inch in the breadth or thicknes, then you may more briefly cast vp the content thus: Multiplie the number of inches in the breadth by the number of inches in the thicknes, and the product thereof multiplie by the number of feete in the length. Then diuide that totall by 144, and the quotient will giue the content of the peece in feete. As in the first example behold.

18 inches breadth. 6 inches thicknes. 9 foote long.

6	
108	10
9	338
972	972(6$\frac{108}{144}$ or $\frac{3}{4}$
	864

Chap. 8.

A ſecond way how Timber may be meaſured by Arithmetick.

Multiplie the breadth in the thicknes, and by the product or ocome thereof diuide 1728, and the quotient will ſhew you how much in length maketh a foote of that piece; according to which you muſt meaſure the whole piece. And if there be any odde quarters, or halfe inches in the breadth or thicknes, then reduce the two ſides into quarters of inches, as is taught in the laſt Chapter. Then hauing reduced them, multiplie the breadth by the thicknes, and by their product diuide 27648. and the quotient ſhewes you the length of the foote in inches, which you may bring into feete by diuiding them by 12. Behold an example of either kind in the worke following.

Example 1.

16 inches broad. 14 inches thicke.

14	16	
64	380	
16	27 28	(7 $\frac{16}{224}$ or $\frac{1}{14}$ the length of a foote.
224	224	

Example 2.

8 $\frac{1}{2}$ inches broad. 11 $\frac{1}{4}$ inches thicke.

4	3	4
34	24	47
47	48	
238	163	
136	27 62	
1598	27648	(17 $\frac{152}{1598}$
	15988	
	152	

And if you would know how many quarters of an inch any fraction of an inch doth containe: or for example, how many quarters of an inch either of the ſaid fractions of $\frac{16}{217}$ and $\frac{120}{1561}$ doe amount vnto, you neede but diuide their numerators by a quarter of their denominators, or the product of the numerator being multiplied by 4, by all their denominators, and either quotient is your deſire.

Chap. 9.

How Timber of vnequall ſides, may, by Arithmetick, be brought into a ſquare, and ſo meaſured by the common way.

Maſter Digs in his Tectonicon made a Table of Squares, or a table to ſhew the ſquares of any ordinarie peece of timber of vnequall ſides, that ſo they might thereby truly meaſure the peece according to the Rule. Herein Maſter Digs took great paines, worthie to be commended. But men being loth to carrie a table in their pockets for trouble (as it ſeemeth vnto me) did altogether leaue it, and framed to themſelues the ſaid falſe way of haluing ỹ ſumme of the two ſides for the ſquare, which turned to the great loſſe of the buyers. Now my deſire is, that ſeeing men will not vſe that Table becauſe of trouble, that they would learne to carrie the ground thereof in their heads, which is contained in this Chapter. Wherein though there be ſome greater meaſure of Arithmetick required then in the former, namely extraction of the ſquare rote, yet the fruite of that kind of Arithmetick will repay any mans trauaile, that either hath, or will take paines to learne it.

But to performe the queſtion, doe thus: Multiplie the breadth and thicknes of the peece together. Then take the ſquare rote of the product thereof, which ſquare rote is (as we call it) the ſquare of that peece, Then hauing the ſquare

giuen, you are not ignorant how to measure the peece by the rule. As for example: if the peece be 16 inches broade and 4 inches thicke: you must multiply 16 by 4, which makes 64. the square roote whereof is 8 (for 8 times 8 is 64.) Therefore 8 is the square of that peece, and not 10 as your common way tels you.

If the roote cannot be exactly extracted, as oftentimes it cannot, take the neerest that you can, and which you shall thinke requisit, by such wayes as are alreadie extant in diuers authors.

Chap. 10.

A second way to finde the square of an vnequall sided peece of Timber, namely, by the Scale and compasse.

Because this way is more easie and speedie then the former, and that which may also be done by those that haue no Arithmeticke: therefore I haue added this vnto the other.

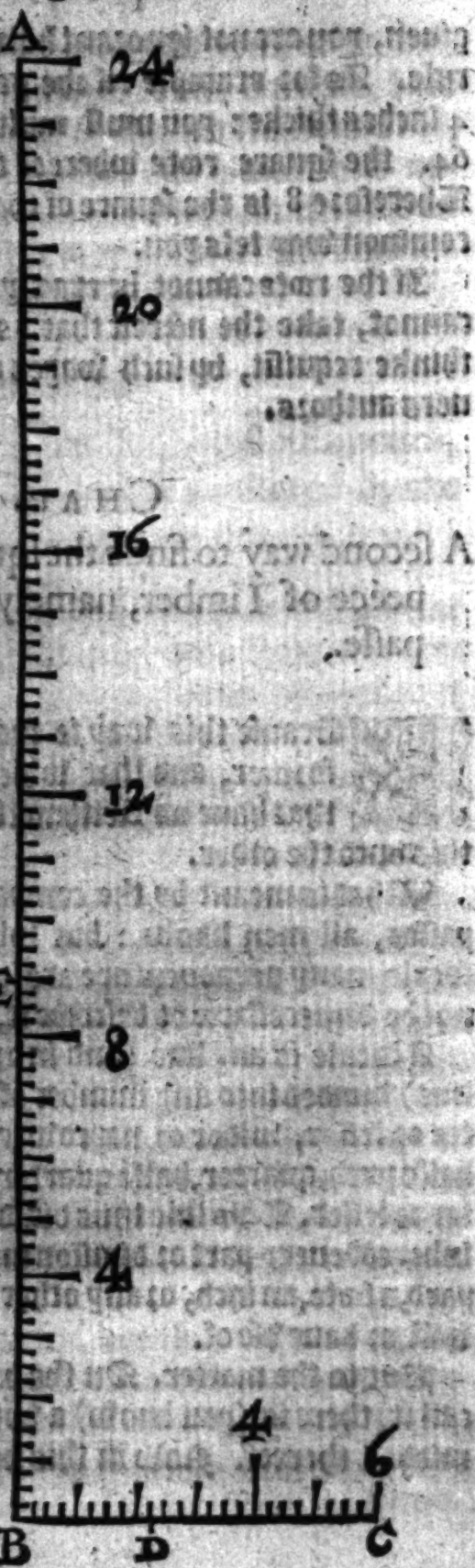
What is meant by the compasse, that is, a paire of compasses, all men know: but what is meant by the terme Scale, many peraduenture are ignorant of: therefore it shall not be vnnecessarie to describe it, as in this manner.

A Scale is any line (and in ordinarie matters, any right line) diuided into any number of equall parts, be they greater or lesser, wider or narrower, of the distance of an inch, halfe ynch, quarter, halfe quarter, or any other distance greater or lesser. This line thus diuided, is, I say, called a Scale; whereof euery part or diuision may stand for a mile, a rod, a yard, a foote, an inch, or any other kinde of measure what you will, or haue vse of.

But to the matter. On the backe-side of the Rule (as we call it) there is (you know) a voide rowme or place, about the middest thereof. Now in this voyde place, draw a line, as

nére to the edge of the Rule as conueniently you can, some fiue or seauen inches long, as here I haue drawne the line A B. Then from it, (and not from the edge of the Rule) and at the bottom of it, draw another line thwart or crosse the Rule, which shall stand square or perpendicular to the former line, as is this line B C. Then must these two lines of A B and B C be diuided into quarters of inches, beginning from the angle or corner at B: and euery one of those quarters of inches, diuide into foure equall portions or diuisions, as here I haue diuided them.

Here I pray you note once for all, that I call all those quarters of inches, Parts of the Scale: euery one of which parts in this matter, is, or standeth for an inch; and halfe a part is halfe an inch; a quarter of a part is a quarter of an inch; three quarters of a part is three quarters of an inch, and so forth. This done, your Scale is prepared.



Now

Now to finde the ſquare of any peece of Timber: firſt adde the breadth and thicknes together. That done, note the halfe thereof: note alſo what is halfe the difference of the two ſides of the peece. Then reckoning how many inches and what od quarters of an inch there is in the ſaid halfe of both the ſides added together, you muſt open your compaſſes (being ſmall or ſharpe in the points) to ſo many parts and ſuch od quarters of a part in the Scale. That don, ſet one foote of the compaſſes being ſo opened, vpon the line B C, ſo many parts and od quarters of a part from B, as there be inches and od quarters of an inch in halfe the difference of the ſides: And extend the other foote of the compaſſe vpon the line A B, and note where it cuts it, or lights vpon it. Now I ſay, that ſo many parts and od quarters of a part of the ſaid line A B, as are from B to the place where the compaſſes did cut or light, ſo many inches and od quarters of an inch is there in the ſquare of the peece.

Or, (which is all one) note what either of the two ſides doth differ from the ſaid halfe of the ſum of both ſides.

This is far ſoner wrought then ſpoken, and is better explained by an example, then taught by a rule. Therefore ſuppoſe the peece to be meaſured, be 7 inches one way, and 11 inches and a halfe the other way. Firſt I adde 7 to 11 ½, which makes 18 ½. Then I note the halfe thereof, which is 9 ¼. I note alſo halfe the difference of the two ſides, which is two and ¼. Laſtly I open my compaſſes as wide as nine parts and one quarter of a part, and ſet one foote at D, which is two parts and ¼ from B, and I extend the other foote to the line A B, and it cuts or lights at the point E. Then I ſay that the ſquare of that peece, is very néere nine inches, becauſe there are from B to C almoſt nine parts.

And here note, that whereas I ſuppoſe the Scale to be quarters of inches, you may make them to be halfe quarters of inches. And truly where the lines A B or B C will not admit or receive all the inches they ſhould (which yet I thinke will rarely happen) there you muſt take for your Scale, halfe quarters of inches, and ſo proceede (as is before ſhewed) as if it were of quarters of inches.

Note.

Note

Note also that this Scale may as fitly be made on your squire; or else on the forefide of the Rule, taking for the line A B, the line next to the edge of the Rule, as it is commonly diuided into quarters of inches, without any subdiuisions into foure, for you may well enough gueſſe at them without any error to be reſpected: take also for the line B C, any one of the thwart ſtrokes which ſerues to diuide the Rule into inches (for I ſuppoſe them to ſtand square to the ſaid other line;) which thwart ſtroke you muſt also diuide into quarters of inches, as before is taught. And thus if one of the thwart ſtrokes ſhould be worne out with pricking (which will not be in ſhort time, if you worke lightly and with ſmall pointed compaſſes) then you may take another of the thwart ſtrokes, and diuide it into quarters, and ſo proceede as before.

Chap. 11.

How that meaſure which is called boord-meaſure is gathered.

Boord-meaſure, or the table of boord-meaſure, is nothing els but that which ſheweth the length of a foote of boord or planke, at any breadth: though commonly we gather this meaſure, but for euery breadth from one inch to thirtie fiue inches, and ſo ſet them downe in order, as in the table of boord-meaſure following, which is from one to thirtie. Now you may finde the length of a foote at any breadth thus. Diuide one hundred forty foure (which is the number of inches in a foote of boord) by the breadth that giuen, and the quotient will ſhew you how many inches makes a foote in length at that breadth. As for example. Diuide one hundreth fortie foure by the breadth fourteene, and the quotient will be 10 $\frac{4}{14}$ or $\frac{2}{7}$, that is, the length of a foote at 14 inches broade, is 10 inches and two ſeuen parts of an inch. So diuide 144 by the breadth 4, and the

quotient

quotient will giue you 36 inches for the length of a foote at that breadth of 4 inches. This 36 diuided by 12, will giue you in the quotient the number of feete therein, which is iuſt three.

But if you will gather your table of bord-meaſure, for bordes that haue odde quarters of an inch in their breadth: then diuide 576 (which is the number of quarters in a foote of bord) by the number of quarters of inches in the breadth, and the quotient will giue you in inches, the length of a foote. As for example, let the breadth be 7 inches and a halfe: This is in all 30 quarters of an inch. By this 30 I diuide 576, and the quotient is 19 $\frac{6}{10}$ or $\frac{1}{5}$, that is, the length of a foote is 19 inches and a fift part of an inch.

CHAP. 12.

How that meaſure which is called Timber-meaſure is gathered.

TImber-meaſure, or the Table of Timber-meaſure, is that which giueth the length of a foote of Timber at any ſquare. But our ordinarie Timber-meaſure is gathered, onely from the ſquare of one inch to the ſquare of 36 inches. It is thus gathered. Multiply the number of inches in euery ſquare, by it ſelfe: then by the ofcome or product, diuide 1728 (which is the number of inches contayned in a foote of Timber) and the quotient will giue you in inches, the length of a foote of Timber at that ſquare. As for example: let the ſquare be 18. This 18 multiplyed in it ſelfe, makes 324: by which, diuide 1728, and the quotient will be 5 $\frac{108}{324}$ or $\frac{1}{3}$, that is, the length of a foote, is 5 inches and one third part of an inch.

But if you will gather your table of Timber-meaſure, for ſquares that haue odde halfes or quarters of an inch; then multiply the number of quarters of inches in the ſquare, by it ſelfe; and by the product or ofcome thereof, deuide

27648 (which is one fourth part of the quarters of inches contayned in a foote) and the quotient will giue you the length of a foote in inches: which you may reduce into féete, by diuiding them by 12. As for example: let the ſquare be 16 and ¼. Firſt I bring them into quarters, which is 67. This 67 I multiply in it ſelfe, and it makes 4489. By this 4489 I doe diuide 27648, and the quotient will be 6 $\frac{2174}{4489}$ which is 6 inches, and ſome what more then a firt part of an inch.

The Table of Boord-meaſure.

THough Maſter Digges in his ſaid Tectonicon, hath ſet downe two Tables, the one for bord-meaſure, and the other for Timber-meaſure: yet becauſe thoſe that here follow, doe differ, both in matter and fourme; I haue therefore ſet them downe, with this explication of them inſuing.

But firſt note: that whereas Maſter Digges in both Tables, hath procéded from one inch to 36 inches: I haue gon no farther then to 30 inches: and indéede it were no great matter, if they went but to 24 inches. For when the breadth of bord, or the ſquare of Timber, doe excéede 24 inches, but eſpecially 30 inches; then they giue ſo little for the length of a foote, as that the oft drawing of that length vpon the bord or Timber, cannot but bréede apparant error, except great héede be taken. Therefore for your bord, if it excéede 30 inches in breadth, you may meaſure it as if it were halfe ſo broade, and count euery foote for two foote. And as for your Timber, if the ſquare thereof excéede 30 inches, or rather 24 inches; then meaſure it as if it were halfe that ſquare (as for example, if the ſquare be 32 inches, then accoumpt it as 16 inches) and then accoumpt euery foote for foure foote.

Note alſo that I haue left out of this Table of bord-meaſure (of that which Maſter Digges hath ſet downe in his

Table)

Table) what maketh a foote at any number of inches and an od quarter or three quarters of an inch, both because they are not, neither can conueniently be set on the Rule, as also for that no losse of any moment comes by getting at them. And therefore I haue contented my selfe to set downe onely inches and halfe inches. But if any man like to obserue iustly what maketh a foote of bord at any number of inches, and a quarter of an inch or three quarters of an inch, then either he may repaire to Master Digges his Table, or else let him finde it out by the way taught in the eleuenth chapter of this second part. But to returne to the meaning of this Table of bord-measure.

In the row A B, is set downe one vnder another, the breadth of bords from one inch to 30 inches, as you may plainly perceiue by looking on it. Euery one of these numbers from one to 30, I will call a Breadth. In the colum vnder the letter C, is set downe against euery breadth, the number of feete, inches, and parts of an inch, that make a foote in length at that breadth. (The feete in either of the colums, stand in the narrow row, at the left side, and the inches and parts of an inch in the

A	C	D
1	12	8
2	6	4 9 3/5
3	4	3 5 1/7
4	3	2 8
5	2 4 4/5	2 2 2/11
6	2	1 10 : 1/7
7	1 8 4/7	1 7 1/5
8	1 6	1 4 16/17
9	1 4	1 3 3/19
10	1 2 2/5	1 2 · 3/4
11	1 1 1/11	1 : 1/2
12	1	11 · 1/2
13	11 1/13	10 2/3
14	10 2/7	9 · 7/8
15	9 3/5	9 · 2/3
16	9	8 · 3/4
17	8 · 1/2	8 · 1/5
18	8	7 · 4/5
19	7 4/7	7 · 1/3
20	7 1/5	7 1/11
21	6 6/7	6 · 5/7
22	6 : 1/2	6 · 3/8
23	6 : 1/4	6 · 1/8
24	6	5 · 7/8
25	5 : 3/4	5 11/17
26	5 : 1/2	5 · 3/7
27	5 1/3	5 · 2/3
28	5 1/7	5 1/10
29	5	4 7/8
30	4 4/5	4 · 5/7

the broder row at the right ſide thereof. Note alſo, that where as you ſée in the fractions, ſometimes one pricke, ſometimes two prickes, that when one pricke ſtands before the fractions it ſignifies a litteleſſe; and two prickes a little more.)

Now if that the breadth of the bord be a certaine number of inches and one halfe inch, then is the length of a foote ouer againſt thoſe number of inches, in the colum vnder D.

But becauſe an example will giue more light then many words otherwiſe: Therefore ſuppoſe the bord to be 11 inches broade: then finde 11 in the row A B, and ouer againſt it in the colum C you ſhall ſée 1. 1 and $\frac{1}{11}$, which is one foote, one inch, and one eleuenth part of an inch.

But if the bord were 11 inches and $\frac{1}{2}$ broad: then ſéeke the length of a foote ouer againſt that 11, in the colum D, and it is 12 inches and $\frac{1}{2}$. So if the breadth of the bord were 25 inches and $\frac{1}{2}$: loke for 25 in the row A B, and ouer againſt it in the colum D, you ſhall ſée fiue inches and fiue ſeauenth parts of an inch. And let this ſuffice for the Table of bord-meaſure.

The Table of Timber-meaſure.

IN the row A B is ſet downe the ſquares of Timber from one inch to 30 inches. Ouer againſt euery one of theſe, in the colum vnder C, is ſet downe the length of a foote, in fóete and inches, and parts of an inch. The fóete are ſet downe in the row at the left hand of this colum as farre as the ſquares doe yeld a foote, and the inches and parts of an inch are ſet downe in the row towards the left hand of the ſame colum.

But if the ſquares of the péece of timber be any number of inches betwéene 1 and 10, and an od halfe inch more: then ouer againſt thoſe number of inches in the colum vnder D, you ſhall finde the length of a foote, in fóete, inches and parts of an inch: the fóete ſtanding (as in the other colum) in the

row at the left side thereof, and the inches & parts of an inch, in the row at the right side. The reason why I added those halfe inches from 1 to 10, is, because in measuring of Timber by deducting the lost square, as is set down in the fourth chapter of this second part of this booke, you shal haue occasion oft times to seeke out the length of a sute for a square of one inch and a halfe, two inches and $\frac{1}{12}$, three inches and $\frac{1}{12}$, and so forth to ten inches.

Here farther it is to be noted, that whereas you shall finde for the most part before the numerator of the fractions, sometimes one pricke, sometimes two prickes: that one pricke doth signifie somewhat lesse, and two prickes doth signifie somwhat more. This I haue noted, as Master Digges hath also don, though it matters not whether such more or lesse, were observed or not, seeing no sensible error comes by omitting them.

An example or two in this case shall not be vnnecessarie. If the square of the pece giuen be fiue inches, finde fiue in the row A B, and ouer against it in the colum of C, you shall finde fiue sote nine inches and three twentie fiue parts of an inch. If the square giuen be thirteene, then ouer against thirteene you shall finde on the right side of the colum C, $10\frac{1}{5}$: which is 10 inches and somewhat more then one fift part of an inch, if the square giuen be fiue inches and a halfe: then ouer against fiue, you shall finde the colum D for the length of a sote, three sote foure inches and somewhat lesse then eight ninth parts of an inch: more examples needes not. Enough hath been said to any that is but of meane capacitie and desirous to learne.

The end of the second part.

THE THIRD PART OF THE CARPENTERS RVLE,

Containing ſundrie true waies to meaſure *ſuperficies and ſollids, or (as wee call them) Boords and Timber, of extraordinarie formes.*

CHAPTER. I.

The meaning of certaine tearmes of Geometrie generally vſed in this third part.

When I had written the former part of this booke concerning meaſuring of ordinarie Timber and Bord, and did conſider, that beſides the pleaſure, there would come ſome good to Carpenters, if they could alſo meaſure extraordinarie fourmes: I haue therefore thought good to adde this part vnto the other two. True it is, that Maſter Digs in his Tectonicon hath not been ſilent of the moſt of theſe things. But becauſe he applies them to meaſuring of land, few or none doe thinke that they belong alſo to meaſuring of Timber: and therefore my labour I hope is not vnneceſſarie, though I ſhould but haue repeated the ſame thing and apply them to our vſe, without adding any other thing.

I haue knowne ſome that would buy whole frames readie wrought by meaſure: but ſure I am that no Carpenter could haue meaſured it for them, without the knowledge of that which is written hereafter.

And

And becauſe I ſhall haue occaſion to vſe many tearmes of Geometrie, by which I may with moze eaſe deliuer, and you with moze plainnes perceiue my minde in theſe things: I haue therefoze ſet downe the meaning, as plainly as I can, of ſome Geometricall tearmes, which moſt ſerue foz our preſent purpoſe. And in this Chapter I explaine onely thoſe tearmes that generally I vſe throughout this whole part, and which doe not properly belong to any one chapter. The reſt I will declare in the beginning of euery chapter, as the matter thereof gines occaſion. But to the matter.

1. An Angle is nothing els but a cozner, made by the méeting of two lines (foz I ſpeake not of ſollid Angles).

2. A right Angle (which wee call a ſquire oz a ſquare Angle) is that whoſe two lines compzehending oz making the Angle, ſtand perpendicular oz plumbe the one to ẏ other.

3. An oblique Angle (which we call beuell oz ſkew) is euery angle not being a right angle, whether it be greater oz leſſe, oz (as we ſay) whether it ſpzead oz clitch.

4. A Superficies, is that which hath onely length and bzeadth, and no thicknes at all. Here note, that whereas we call bozds, ſuperficies, and Timber ſollids, it is not becauſe a bozd is not a ſollid (foz it hath length, bzeadth and thicknes) but becauſe we reſpect not (in meaſuring of them) but only their length and bzeadth.

5. A Sollid (oz a bodie) is that which hath length, bzeadth, and thicknes.

6. Parallels are thoſe lines, ſuperficies, oz ſollids, that differ euery where alike, oz are not nérer together in one place then in another.

7. A Figure, is any kinde of ſuperficies oz ſollid that is bounded about, as Triangles, Squares, Circles, Globes, Cones, Pziſmes, and the reſt.

8. The Baſe of a Figure, is any ſide (as wee may ſay) thereof, vpon which it may be ſuppoſed to ſtand. Oz if you take any ſide of a figure foz the ground oz bottome oz lower part thereof, that ſame is the Baſe.

9. The

9. The height of a figure, is the length of a Perpendicular or plumme line falling from the top thereof, to the base, ground, or bottome thereof. And whether this Perpendicular or plumme line fall within or without the figure, it makes no matter, so as it be neither higher nor lower then the base or bottome.

CHAP. 2.

How to raise and let fall a Perpendicular.

A Perpendicular line is that which stands plumme vpright vpon another, leaning neither the one way nor the other. A Perpendicular is said to be raised, when a point is giuen in a line, from which it must rise. It is said to bee let fall, when a point is giuen aboue the line, from which it must fall.

Now besides that you may both raise and let fall a Perpendicular by a squire or square: there are many waies Geometrically to doe both the one and the other. And because there is especiall vse in this third part, of letting fall a perpendicular or plumme line from a point giuen, as also from an angle in a figure to the base: I would not haue men ignorant how to doe the same without a squire, which is not alwaies at hand, when a rule & paire of compasses are. And yet I will set downe onely one way of many, to auoide tediousnes, which is thus.

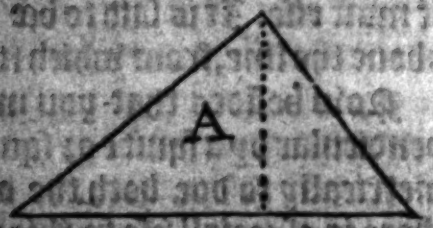
Let the point giuen be A, the line giuen B C. Open the Compasses to any distance conuenient, and setting one foote in the point A, make an arke or peece of a Circle with the other foote, till it cut the line B C twice. Those two places of cutting we call Intersections,

and are here in this example at B and C. Then finde the middle betweene those two Intersections, and from that middle draw a line to the point A (which is the point given) and that line shal be perpendicular or plumbe from the point A to the line B C, as was required.

Chap. 3.

Of a Triangle and a Prisme, what they are, and how they be measured.

TRiangles are made of straight lines, or crooked lines, or of both together. But I speake only of right lined Triangles, which are thus defined. A Triangle is that which is comprehended of three right lines, as is the figure marked with A.



Triangles are diuers, both in respect of their sides and angles, and may bee measured diuers wayes: But let this one way serue for all. Multiplie halfe of the base by all the height or perpendicular: Or (which is all one) multiplie all the base by halfe the height or perpendicular; and either of the products gives the content of the Triangle.

Here I pray you remember what I meane by the base and height or altitude, according as was shewed in the former Chapter. In this figure you may suppose the longest line to be the base, and then the prickt line is the height or perpendicular.

Now note, that a Prisme is that whose two opposite plaines or ends be equall, like, and parallell, the other sides being parallelograms, that is, figures whose opposite sides are equall, and whose angles be all right angles. So that euery peece of timber may be called a Prisme, not being vnder at one end then at another, of what fashion soeuer it be,

whether the base or end thereof be of three sides, as cants; or of foure, fiue, sixe, or more sides, as other timber; and whether the sides be of equall length or of vnequall.

How to measure any Prisme or peece of timber of whatsoeuer fourme or fashion the base or end thereof is; you neede but multiplie the content of the base or end by the altitude or height, or (as wee call it) the length of the peece, and the product giues the content thereof.

This might serue once for all, as sufficient to measure solids or timber, whose bases or ends are like and equall: so that it needed not but to teach how to measure euery kinde of base, as Triangles, Quadrangles, &c. But yet for plainnes sake, I will giue examples of euery forme, with some varietie of measuring them, when I speake of measuring plaine figures as being their bases.

1. Therefore if the base of your Prisme or peece of timber were the said figure A, multiplie the content of the Triangle A by the length of the peece, and the product giues the content thereof.

2. Or els you may measure that Prisme or peece of timber thus: Take the whole perpendicular, and suppose it to be one side of a squared peece of timber (as we call it) and take halfe the base for the other side: and so measure it by any of the waies taught in the second part of this booke.

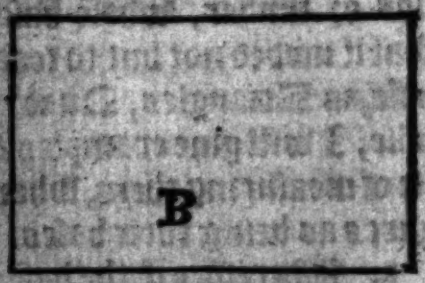
This being vnderstood which is here written, the vse hereof is very generall. For besides that the Carpenter may measure hereby any canted peece of timber, as steps for staires, and canted ralles, and such like: the plaisterer also, who often worketh by the yard, may hereby measure gable-ends, and such like fourmes. The Glasier hath likewise vse hereof: and also it may stand the Mason oft in stead.

Chap. 4.

What a Parallelogram is, and how it is measured.

A Parallelogram is a figure whose oppoſit ſides are equall, and whoſe angles or corners are all right or ſquare angles: ſuch as is the figure B.

Note that whereas I ſay all right angles, it is but to diſtinguiſh betwixt this figure, and the two next following, for they are Parallelograms alſo.



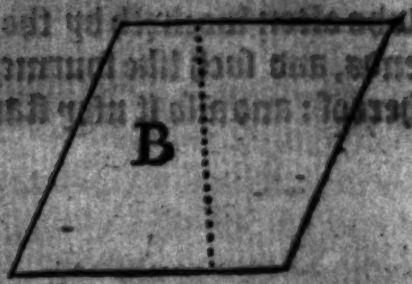
It is measured thus: Multiplie the length by the breadth, and the product or ſo-come gives the content.

The prisme or peece of timber whoſe baſes or ends are parallelograms, as is the ſaid figure B, you may measure thus: Multiplie the content of the baſe by the length, and the product yeelds the ſollid content, as is taught in the ſeuenth Chapter of the ſecond part of this booke.

Chap. 5.

What a Rombus is, and how it is measured.

A Rombus, otherwiſe called a Diamond forme, is a figure of foure equall ſides & oblique angles: Or, the ſides are all of one length, and none of the angles are ſquare, ſuch as is the figure B.



The meaſure of a Rombus is thus. Multiplie the length of one of the ſides, by the perpendicular plumme line, drawne from that ſide to the oppoſite ſide, which in this figure is the prickt line, and the product yeelds the content.

2. The

1. The prisme or peece of timber whose bases are a Rombus, is measured thus. Multiplie the content of the base or end by the length, and the product giues your desire.

2. Wedels (as in the third Chapter of this part) take all the perpendicular for one side of a squared peece, and one side of the figure B for the other side of the squared peece, and so measure it by any of the waies taught in the second part of this booke.

Chap. 6.

What a Romboides is, and how it is measured.

A Romboides (called a Diamond-like figure) is that whose opposite sides and opposite angles are equall. But all the sides are not equall, neither is any of the angles right: such is this figure C.

The measure differeth nothing from the measuring of a Rombus in the former Chapter, and might well haue bin ioyned together: so that he that can measure one can measure both. But to the former waies you may adde this, if you please. First diuide it into two Triangles, as here this figure is by the pricke line. Then measure one of those Triangles by the way set downe in the third Chapter of this part: the double whereof is the content of this figure. The like is also to be done with a Rombus or a Parallelogram.

The Prisme or peece of timber whose bases are a Romboides, is measured as a peece whose base is a Rombus, as in

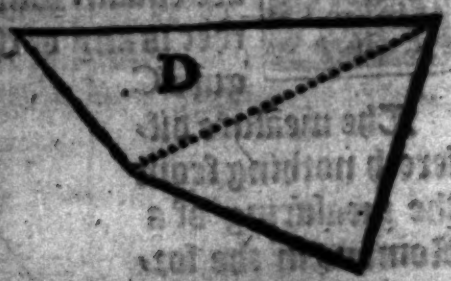
the former Chapter. But if you measure the base or end by two Triangles, as in this Chapter, then take as for the sides of a squared peece of timber, all the perpendicular of one of the Triangles, and all the base of the same Triangle, and so measure it by any of the wates taught in the second part.

Chap. 7.

What a Trapezium is, and how it is measured.

A Trapezium is a figure of foure sides, not hauing all the sides and angles equall, as is the figure D.

It is measured thus. First diuide it into two Triangles, by drawing a line from one angle to the opposite angle; as here the figure D is diuided by the prickt line. Then measure by the way taught in the third Chap. of this 3. part, both those triangles, seuerally: and adde both their contents for the content of the whole Trapezium.



1. The prisme or peece of timber, whose end or base is a trapezium, as the trapezium D, may be thus measured. Multiplie the content of the base or end, by the length of the peece, and the product gines the content thereof.

2. Or els, take the square roote of the content of the base or end D; and so measure it by any of the wates taught in the second part.

3. Or els, suppose the peece to be cut into two Cants, according as the base or end thereof D is diuided. Then measure both those Cants, by the way taught in the third chapter of this part, and take the summe of those two Cants for the content of the whole peece.

Chap. 8.

What a regular mani-sided figure is, and how it is measured.

A Mani-sided figure, is that which hath more sides then foure. They are either regular or irregular. A regular mani-sided figure is that whose sides and angles are al equal,

as is this figure marked with A.

An irregular, is that whose sides or angles are vnequall.

A regular mani-sided figure is thus measured. First draw a perpendicular from the center of the figure to the middle of one of ỹ sides, as is the short prickt line in the said figure A. Then seeke the length or compasse about of all the sides: the halfe whereof you must multiplie by the length of the said perpendicular, and the product gives the content of the figure.

Now the center of a regular mani-sided figure is thus found: Raise a perpendicular vpon the middle of any two of the sides not being directly opposite, and where they intersect or cut one another, there is the center of the figure.

By this may you finde the center of a Circle, or of any peece of a circle, namely, if you draw any two right lines, either equall or vnequall, in the circle or peece of the circle, and from their middles doe raise perpendiculars: I say, the meeting of those perpendiculars, is the center of the circle or peece of a circle.

But if the figure haue an euen number of sides, as 6, 8, 10, and so forth; then you neede but draw a line from any two opposite angles, and another line from any two other opposite angles: and where those two lines doe cut, there is

is the center of the figure. Thus haue I drawne the two long prickt lines to finde the center of this figure A.

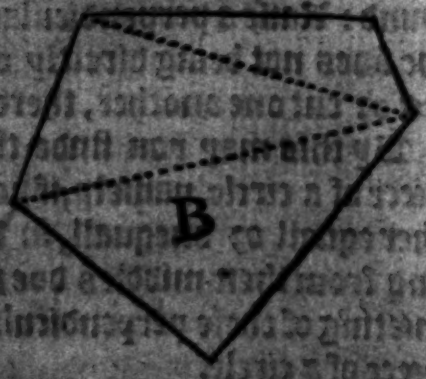
1. The prisme or peece of timber whereof the figure A, or any other regular mani-sided figure is the base or end, is measured by multiplying the content of the base by the length of the peece, and the product giues the solide content.

2. Or els, take the halfe of all the sides or compasse about as for one side of a squared peece of timber, and the said perpendicular for the other side, and so measure it by any of the waies taught in the second part.

Chap. 9.

How irregular mani-sided figures are measured.

IRregular mani-sided figures, as also regular mani-sided figures, may be thus measured. Diuide the figure into triangles, as here I haue diuided the figure B by certen prickt lines. Then measure each triangle by it selfe, as is taught in the third Chapter of this part, and adde the contents of all the Triangles together; and their summe or totall is the content of the figure.



1. The prisme or peece of timber, whose base or end is the figure B, or any other vnequall mani-sided figure, is measured by multiplying the content of the base or end in the length of the peece, and the product giues the solide content.

2. Or els, take the square rote of the number of inches in the content of the base, and so measure it by any of the waies taught in the second part of this booke.

3. And because for the measuring of euery foot of timber

I haue vsed to set downe some way by which it may be done without Arithmeticke: Therefore for a third way; as euery triangle in the figure B is measured, so measure so many solids whereof the triangles be the bases, and whose lengths are ỹ length of the irregular péece of timber, as is taught in the third Chapter of this third part; and then adde all their contents for the content of the whole péece.

CHAP. 10.

What a Circle, a Semicircle, and a Sector are, and how they be measured.

1. A Circle is a figure, plaine and round.

2. The round line ỹ makes the Circle is called the Circumference.

3. The point in the middle of the circle is called ỹ Center.

4. The line (and indéed euerie line) passing by the Center to both sides of the Circumference, is called the Diameter, as ỹ black line in this circle C.

5. Halfe the Diameter, and indeede euery line passing from the Center to the Circumference, is called the Semidiameter.

6. All lines in the Circle (except the Diameter) which are drawne from side to side, are called Coords. Such is the prickt line in the circle C.

7. The Diameter cuts the circle into two equall parts; each of which parts is called a Semicircle.

8. A coord cuts the circle into two vnequall parts; each of which parts is called a Section of a Circle. The one is called the greater section, because it is greater then ỹ Semicircle.

The other is called the lesser section, because it is lesse then the semicircle.

9 A Sector is any part of a circle, either greater or lesser then a semicircle, contained vnder two semidiameters meeting in the center, and a peece of the circumference.

10 Note that the circumference of a circle is triple the diameter, and almost one seauenth part more. But we count it as iust triple and one seauenth part, or as 22 is to 7. Therefore to finde the circumference, the diameter being knowne; multiply your diameter by 22, and diuide the product by 7, and the quotient shewes you the circumference.

To measure a Circle. Now to measure a circle doe thus. Multiplie halfe the diameter by halfe the circumference; or all the diameter by a quarter of the circumference; or all the circumference by a quarter of the diameter; and any of the products giues the content of the circle.

To measure a Semicircle. The Semicircle is thus measured. Multiply halfe the diameter in halfe the arke or arch thereof; or all the diameter in a quarter of the arke thereof, &c. And either of the products giues the content of the semicircle.

To measure a Sector. A Sector is measured as a semicircle, namely by multiplying halfe the semidiameter in halfe the arke or arch thereof, &c. the product whereof is the content of the sector.

1 The solid or peece of Timber whose end or base is a circle, a semicircle, or a sector, may be thus measured. Multiply the content of the base or end in the length of the peece, and the product giues the solid content.

2 Or, take the semidiameter for one side of a squared peece of Timber, and halfe the arke (be it of a circle, semicircle or sector) for the other side, and so measure it by any of the wayes taught in the second part.

*For the greater measure the greater error in this kinde of worke. Here it were not vnnecessarie to shew how to finde the quantitie of an arke or peece of a circle. But of the diuers wayes that are found, you may vse this. First hauing taken the length of your semidiameter in any measure, which let be for more conuenience in * inches, then open your compasses

to

to an inch, and see how many of them is contained in your arke.

Chap. II.

How to measure Sections of a Circle.

I Told you in the last chapter that there be two sorts of sections, a greater which is more then a semicircle; and a lesser, which is not so much as a semicircle. They are measured diuersely.

To measure a greater Section.

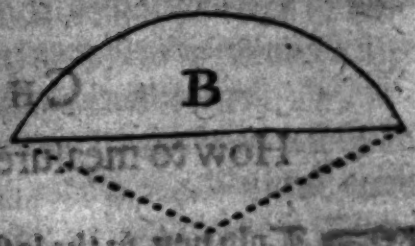
A greater section is thus measured, draw two semidiameters from either end of the arke to the center, as the two pricke lines in the figure A. Then Multiply halfe the arke in the semidiameter, and to the product thereof adde the content of the said triangle, made of the cord and the two semidiameters, and the totall will be the content of the whole section.

The solid or péece of Timber, whose base is the figure A or any greater section of a circle, is found as before is oft said, by multiplying the content of the base in the length of the péece.

Or take halfe the arke as one side of a squared péece of Timber, and the semidiameter as the other side, and so measure it by any of the wayes in the second part: then adde thereunto the content of the solid, whereof the triangle before named is the base, and the totall will be the content of the solid, whose end is the said section.

To measure a lesser section.

A lesser section is thus measured. Draw two semidiameters from either end of the arke vnto the center of the Circle, whereof this section is a part, as be the two prickt lines without this figure B. Then multiplie halfe the arke in the semidiameter; and out of the product thereof, take the content of the triangle made of the corde and the two semidiameters, and the remainder will be the content of the lesser section B.



The sollid or peece of timber, whose base or end is the figure B, or any lesser section of a circle, may be measured as before is taught, by multiplying the content of the figure in the length of the sollid.

Or els, take halfe the arke as one side of a squared peece of timber, and the semidiameter for the other side, and so measure it by the waies in the second part of this book. Then deduct out of the content thereof, the content of the sollid or peece of timber, whereof the triangle made of the corde and the two semidiameters, is the base or end: and the remainder is the content of the sollid, made vpon the said lesser section B.

To measure an Ouall.

In the 6. chapter of the second part of this book, I told you that I would shew you in the end of this Chapter, how to measure an Ouall: which in a word is thus. First finde (by that which is taught in the 8. Chapter of this part) the foure centers of the foure arkes or peeces of circles, whereof the Ouall is made (for euery Ouall is made, by ioyning together foure seuerall arkes or peeces of circles, whereof those at the two ends are equall, and those at the two sides are also equall). Then hauing found those arkes, draw their cords vnder them: so shall you see the whole Ouall to be diuided into foure lesser sections of a circle and a parallelogram. Therfore measure all those foure sections, as afore is taught in this

this Chapter; and measure also the parallelogram, by the way taught in the third Chapter of this third part: and the content of them all (that is, of those foure sections and the parallelogram) is the content of the Quall.

Note, that when you haue measured one section at the end of the Quall, you haue also the content of the other section at the other end (because they are equall): Therefore you neede but to double the one, and so you haue the content of them both. In like sort may you doe with the sections at the sides, that is; hauing measured the one, doe but double it for the content of them both.

If a peece of timber haue Quall fashion, that is, haue his base or end like an Quall: then it may be measured by multiplying the content of the base by the altitude or length of the peece, as hath been often mentioned.

Note further, that by this which is here taught, and by that which is afore written of triangles and many-sided figures, you may measure any kinde of figure, either plaine or solid, that is made of straight lines and circular lines together, if you doe but vse diligence, and deuide or imagine a diuision of the whole figure into his proper sections and other figures as becommeth; and so measure those sections and other figures severally, and thē adde their contents together.

CHAP. 12.

What a Pyramis is, and how it is measured.

A Pyramis is a solid figure, contained vnder many plaine superficies set vpon one plaine superficies, and gathered together into one point, as this pyramis A. Pyramids are diuers according as their bases be diuers, as of 3. 4. 5. or more sides, as is at large shewed in the 10. definition of the 11. booke of Euclides Elements of Geometrie.

To measure the sollid content of a Pyramis.

But of what sorts soeuer the pyramids be, they are measured by one rule, which is thus: Multiplie the altitude or height by the third part of the content of the base: or contrarily, multiplie the content of the base by the third part of the altitude or height, and either of the products is the content sollid of the pyramis.

Here note, that the altitude or height is not the length of the side of the pyramis, but (as I told you in the first chapter of this third part) it is the length of the perpendicular or plumme line, falling from the point or top thereof, to the base or bottome.

To measure the superficiall content of a Pyramis.

But if you would measure the superficies or outside of a pyramis: then (in so much as all the sides are triangles) measure euery triangle by it selfe, and to all their contents adde the content of the base, and the totall or summe is the superficiall content of the pyramis.

Chap. 13.

How to measure parts of a pyramis, or timber that is taper growne.

If a part of a pyramis doe taper much, you may lay it on a paper by a scale, and make it out to a perfect pyramis. Hauing so done, measure the whole pyramis. Measure also that part thereof which was added; which substract or take from the content of the whole pyramis, and the remainder giues the content of the peece of a pyramis. This way is not conuenient in ordinarie tapered timber, and therefore take rather the way here following.

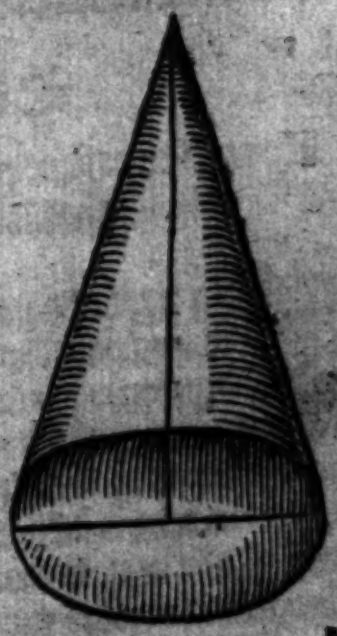
You

You know that in the laſt chapter of the firſt part of this booke, I told you, that if a tapered peece were meaſured by the ſquare of the middle, there was loſt to the ſeller a peece of timber, whoſe length is the firſt part of the length of the whole peece; and which hath for his breadth, halfe the difference of the breadth of both ends; and for his thickneſs, halfe the difference of the thickneſs of both ends. Therefore having meaſured the peece by the ſquare of the middle, deduct the ſaid loſt peece, and the remainder is the content of the tapered peece. This loſt peece you may meaſure (and ſo deduct) thus. Take the halfe of the difference of the breadth of both ends of the tapered peece, for the breadth of your loſt peece; and halfe the difference of the thickneſs of both ends, for the thickneſs of the loſt peece: & with that breadth and thickneſs meaſure it according to the length; which (as I ſaid) is the firſt part of the length of the whole peece. And note, that by the length, I meane not the ſide of the tapered peece, but the plumme or height thereof.

Chap. 14.

What a Cone is, and how it is meaſured.

A Cone is a round pyramis (as it were) which hath for the baſe a Circle, as is this figure. It is largely deſcribed in the 18. definition of the 11. booke of Euclides Elements.



To meaſure the ſolid content of a Cone.

The ſolid content of a Cone is thus meaſured: Multiplie the content of the baſe in ⅓ third part of the height, and the product is the ſolid content of the Cone.

To meaſure the ſuperficiall content of a Cone.

The ſuperficiall content of a Cone is thus found. Multiplie halfe the circuit or compaſſe of the baſe, by

by all the three, that the plaine is the superficiall content of the spire; to which if you adde the content of the base, the total shall be the superficiall content of the whole Cone.

Note here againe, that the line of the Cone is not the height, plaine or perpendicular line from the top to the base, but the length of the edge or sloping of the Cone.

Where are many other kinds of plaines and solides, but I may not stand to locate of them. If any man, either for pleasure or profit, shall desire to know them, or their measure, let him looke into Euclides Elements, Pandects, Sir Digs his plantimetria, Walter Lucars Solace, and other good books of Geometrie, which are extant in English.

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What a Cone is, and how it is measured.

A Cone is a round pyramis (as it were) which hath for the base a Circle, as in this figure. It is largely described in the 18. definition of the 11. booke of Euclides Elements.

The solide content of a Cone is thus measured: Multiple the content of the base in which part of the height, into the quarter is the solide content of the Cone.

The superficiall content of a Cone is thus measured: Multiplie the